

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 09/936432	INTERNATIONAL APPLICATION NO. PCT/EP00/01636	ATTORNEY'S DOCKET NUMBER 213647US0PCT
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24. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

<input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO	\$1000.00
<input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO	\$860.00
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	\$710.00
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)	\$690.00
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)	\$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

\$860.00

Surcharge of **\$130.00** for furnishing the oath or declaration later than 20 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).

\$0.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	13 - 20 =	0	x \$18.00	\$0.00
Independent claims	2 - 3 =	0	x \$80.00	\$0.00
Multiple Dependent Claims (check if applicable).			<input type="checkbox"/>	\$0.00

TOTAL OF ABOVE CALCULATIONS = **\$860.00**

Applicant claims small entity status. (See 37 CFR 1.27). The fees indicated above are reduced by 1/2.

\$0.00

SUBTOTAL = **\$860.00**

Processing fee of **\$130.00** for furnishing the English translation later than 20 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).

\$0.00

TOTAL NATIONAL FEE = **\$860.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).

\$0.00

TOTAL FEES ENCLOSED = **\$860.00**

Amount to be:
refunded **\$**

charged **\$**

- A check in the amount of **\$860.00** to cover the above fees is enclosed.
- Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.
- The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **15-0030** A duplicate copy of this sheet is enclosed.
- Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

 22850 Surinder Sachar Registration No. 34,423

Surinder Sachar

SIGNATURE

Norman F. Oblon

NAME

24,618

REGISTRATION NUMBER

Sept. 13 2001

DATE

213647US-0PCT

JC03 Rad/CR TO 13 SEP 2001

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :

RAINER TRESCH ET AL : ATTN: APPLICATION DIVISION

SERIAL NO: NEW U.S. PCT APPLICATION :
(Based on PCT/EP00/01636)

FILED: HEREWITH :

FOR: AZOXY DYES AND COPPER :
COMPLEXES THEREOFPRELIMINARY AMENDMENTASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

Prior to examination on the merits, please amend the above-identified application as follows.

IN THE CLAIMS

Please amend the claims as shown on the marked-up copies following this amendment to read as follows.

3. (Amended) Azoxy dyes as claimed in claim 1, wherein each R¹ is methoxy.
4. (Amended) Azoxy dyes as claimed in claim 1, wherein the phenyl rings A are unsubstituted or C₁–C₄–alkyl-substituted.
5. (Amended) Azoxy dyes as claimed in claim 1, wherein each R² is carboxyl.
7. (Amended) Copper complex dyes and their mixtures obtainable by reacting the dyes of claim 1 with at least 0.1 mol equivalent of a copper donor.

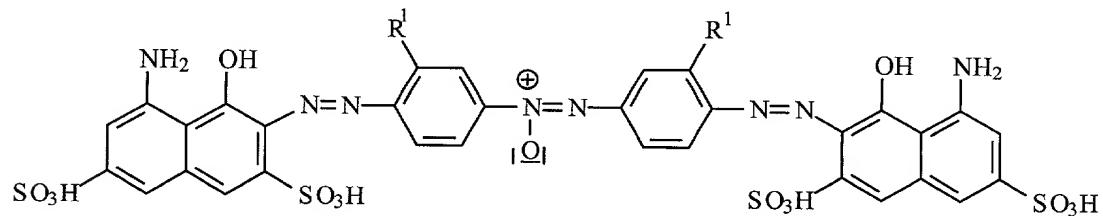
8. (Amended) A process for preparing copper complex dyes, which comprises reacting an azoxy dye of claim 1 with at least 0.1 mol equivalent of a copper donor.

9. (Amended) A method of using one or more azoxy dyes and/or their copper complexes of claim 1 for dyeing or printing natural or synthetic substrates.

10. (Amended) Natural or synthetic substrates dyed or printed with one or more azoxy dyes and/or their copper complexes of claim 1.

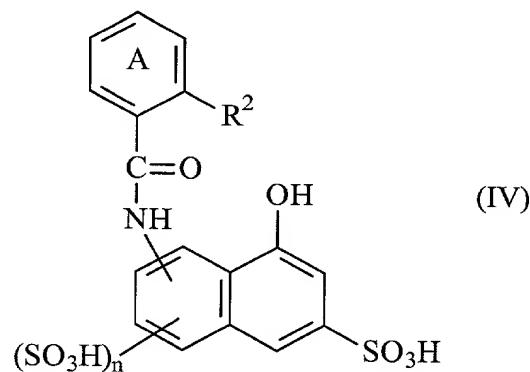
Please add new Claim 13.

13. (New) A process for preparing azoxy dyes of the formula

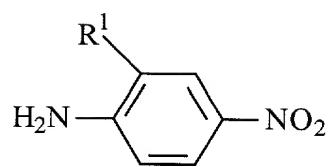


where

R^1 is selected from the group consisting of methoxy, hydroxyl and carboxyl, which comprises coupling a coupling component of the formula IV



with nitroaniline of the formula V



where n, A, R¹ and R² are each as defined in claim 1, reducing the resultant nitro monoazo dye and deacylating in aqueous solution at pH < 9.

REMARKS

Claims 1-13 are active in the present application. Claims 3-5 and 7-10 have been amended to remove multiple dependencies. Claim 13 is a new claim. Support for new Claim 13 is found in the Examples of the Specification. No new matter is added. An action on the merits and allowance of the claims is solicited.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Norman F. Oblon
Attorney of Record
Registration No. 24,618

Daniel J. Pereira, Ph.D.
Registration No. 45,518



22850

(703) 413-3000
Fax #: (703) 413-2220
NFO/DJP/law

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Marked-Up Copy

Serial No.:

Amendment Filed on:

9-13-01

IN THE CLAIMS

Please amend the claims as shown on the marked-up copies following this amendment to read as follows.

--3. (Amended) Azoxy dyes as claimed in claim 1 [or 2], wherein each R¹ is methoxy.

4. (Amended) Azoxy dyes as claimed in [any of claims 1 to 3] claim 1, wherein the phenyl rings A are unsubstituted or C₁-C₄-alkyl-substituted.

5. (Amended) Azoxy dyes as claimed in [any of claims 1 to 4] claim 1, wherein each R² is carboxyl.

7. (Amended) Copper complex dyes and their mixtures obtainable by reacting the dyes of [any of claims 1 to 6] claim 1 with at least 0.1 mol equivalent of a copper donor.

8. (Amended) A process for preparing copper complex dyes, which comprises reacting an azoxy dye of [any of claims 1 to 5] claim 1 with at least 0.1 mol equivalent of a copper donor.

9. (Amended) A method of using one or more azoxy dyes and/or their copper complexes of [claims 1 to 7] claim 1 for dyeing or printing natural or synthetic substrates.

10. (Amended) Natural or synthetic substrates dyed or printed with one or more azoxy dyes and/or their copper complexes of [any of claims 1 to 7] claim 1--

Claim 13 - (New).

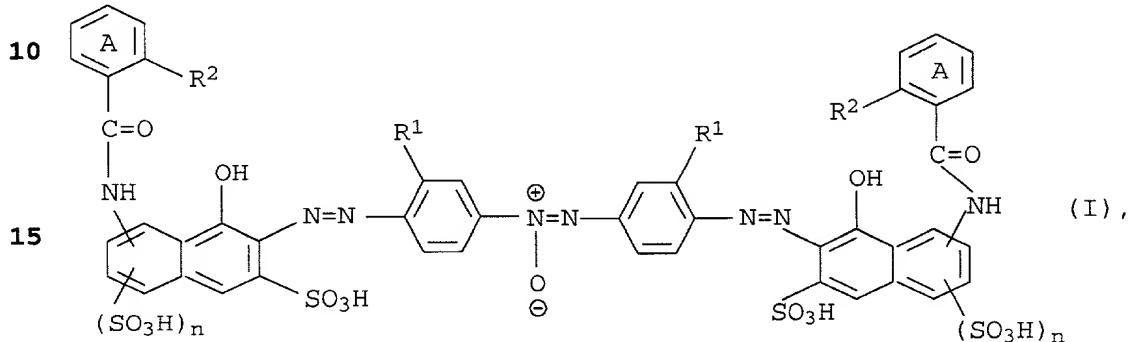
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Azoxy dyes and copper complexes thereof

Specification

5

The present invention relates to novel azoxy dyes of the general formula I in the form of the free acid



20 where

n is 0 or 1, each

25 R¹ is selected from the group consisting of methoxy, hydroxyl and carboxyl, each

30 R² is selected from the group consisting of carboxyl, amino, C₁-C₄-alkylamino, allylamino, benzylamino and methoxycarbonylmethylamino, and the phenyl rings A may additionally be substituted by C₁-C₈-alkyl, unsubstituted or methyl- or halogen-substituted phenyl, hydroxyl, amino, nitro, halogen, carboxyl, N-benzylcarbamoyl, unsubstituted or nitro-, halogen-, C₁-C₄-alkoxy- or acetoxy-substituted phenylcarbamoyl and naphthylcarbamoyl or be benzofused,

35 their copper complexes, a process for preparing the copper complex dyes, azoxy dyes of the formula I in their partially or completely deacylated form, their copper complexes, colorants comprising these azoxy dyes and/or their copper complexes and their use for dyeing and printing natural or synthetic substrates.

40 CH-A-193 343, CH-A-196 252, CH-A-196 259, CH-A-196 260, CH-A-196 264, DE-A-26 51 369, EP-A-648 814 and EP-A-43 792 describe azoxy dyes containing various hydroxyaminonaphthalenesulfonic acids and their copper complexes.

DE-A-28 44 597 teaches a process for preparing copper-containing azoxy dyes whose coupling component is a 4-hydroxy-6-sulfophenylaminonaphthalene-2-sulfonic acid.

5 The prior art dyes are dull and frequently provide unlevel dyeings.

It is an object of the present invention to provide dyes which do not have the abovementioned disadvantages and which possess good 10 application properties.

We have found that this object is achieved by the above-described dyes and their copper complexes.

15 Any alkyl appearing in the abovementioned formula may be straight-chain or branched.

Additionally substituted phenyl rings A may each bear 1, 2, 3 or 4, preferably 1 or 2, substituents, which may be different.

20 Halogen is fluorine, chlorine, bromine or iodine.

R² is for example methylamino, ethylamino, propylamino, isopropylamino, butylamino, isobutylamino, sec-butylamino and 25 tert-butylamino.

Substituents for the phenyl rings A include for example methyl, ethyl, propyl, isopropyl, butyl, sec-butyl, tert-butyl, pentyl, hexyl, heptyl, octyl, 2-, 3- or 4-bromophenyl, 2-, 3- or 30 4-methylphenyl, 2-, 3- or 4-nitrophenylcarbamoyl, 2-, 3- or 4-methoxyphenylcarbamoyl, 2-methoxy-4-nitro- and 2-methoxy-5-nitrophenylcarbamoyl, 2-, 3- or 4-ethoxyphenylcarbamoyl and 2-, 3- or 4-acetoxyphenylcarbamoyl.

35 In the description part and in the claims, the dyes of the formulae I, VI, VII, VIII and IX are depicted in the form of the free acids, but preferably they are present as salts, especially as alkali metal salts, and are isolated as salts from the synthesis. The formula depiction as free acid must therefore, as 40 customary in the dye literature, be considered equivalent to the depiction as salt.

Suitable cations are derived from metal or ammonium ions. Metal ions are in particular the lithium, sodium or potassium ions.

45 Ammonium ions for the purposes of the present invention are unsubstituted or substituted ammonium cations. Substituted ammonium cations include for example monoalkyl-, dialkyl-,

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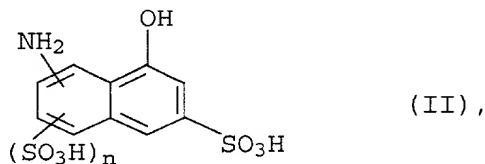
trialkyl-, tetraalkyl- or benzyltrialkyl-ammonium cations for example diethanolammonium or cations derived from nitrogenous five- or six-membered saturated heterocycles, such as pyrrolidinium, piperidinium, morpholinium, piperazinium or

5 N-alkylpiperazinium cations or their N-monoalkyl- or N,N-dialkyl-substituted products. Alkyl is here to be understood as meaning in general straight-chain or branched C₁-C₂₀-alkyl, which may be substituted by 1 or 2 hydroxyl groups and/or interrupted by from 1 to 4 oxygen atoms in ether function.

10

The dyes may be prepared by reacting an aminohydroxynaphthalenesulfonic acid of the formula II

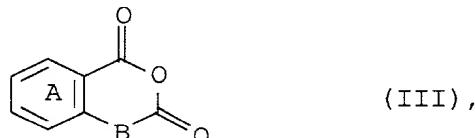
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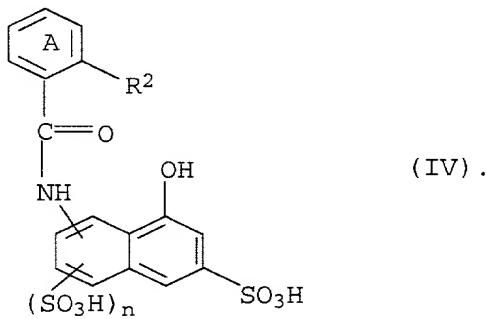
where n is 0 or 1, with an anhydride of the formula III

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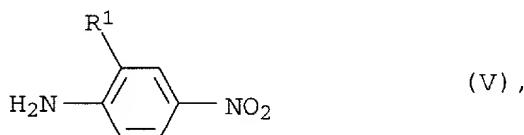
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This coupling component may be coupled with nitroanilines of the formula V

45



where R¹ is as defined above, as diazo component in a conventional manner before two resultant nitromonoazo dyes are reductively linked via an azoxy bridge to form the dyes of the invention.

5 The reducing agents used are preferably reducing sugars, for example D-glucose, in aqueous alkaline solution. The solution may be rendered alkaline for example by means of an alkali metal hydroxide such as sodium hydroxide or lithium hydroxide. Such reductions are common knowledge and described for example in
 10 EP-A-43 792. In addition, a reduction with customary reducing agents such as aldehydes e.g. formaldehyde or hydrazine hydrate is possible.

Suitable aminohydroxynaphthalenesulfonic acids II include for
 15 example 1-amino-8-hydroxynaphthalene-4,6-disulfonic acid,
 2-amino-8-hydroxynaphthalene-6-sulfonic acid,
 3-amino-8-hydroxynaphthalene-6-sulfonic acid,
 4-amino-8-hydroxynaphthalene-6-sulfonic acid and particularly preferably 1-amino-8-hydroxynaphthalene-3,6-disulfonic acid.

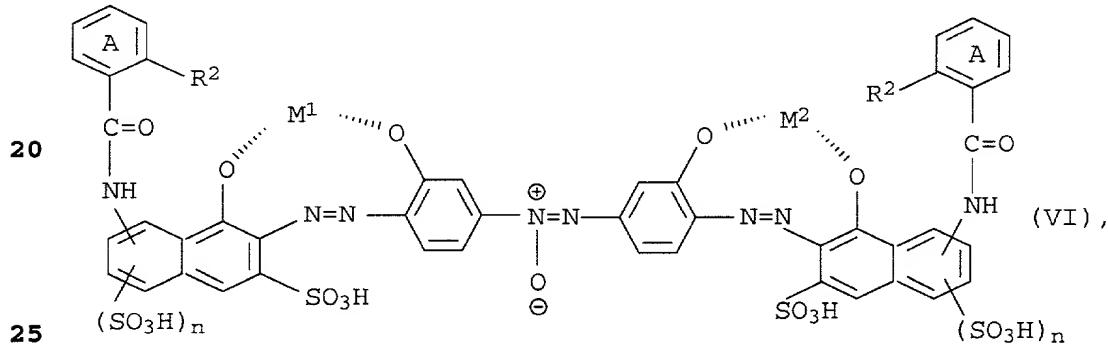
20 Examples of anhydrides III are

-phthalic anhydrides such as phthalic anhydride, 3-methyl-,
 4-methyl-, 3,6-dimethyl-, 4-tert-butyl-, 3,4,5,6-tetramethyl-,
 25 3-o-tolyl-, 3,6-diphenyl-, 3-hydroxy-, 4-carboxy-, 3-amino-,
 3-nitro-, 4-nitro-4-(2,4-dichlorophenyl)carbamoyl-,
 4-(3,4-dichlorophenyl)carbamoyl-,
 4-(2-methoxy-5-chlorophenyl)carbamoyl-,
 4-(3-nitrophenyl)carbamoyl-,
 30 4-(2-methoxy-4-nitrophenyl)carbamoyl-,
 4-(2-methoxy-5-nitrophenyl)carbamoyl,
 4-(4-acetamidophenyl)carbamoyl-, 4-(2-ethoxyphenyl)carbamoyl-,
 4-naphthylcarbamoyl-, 4-benzylcarbamoyl-, 3-fluoro-, 4-fluoro-,
 3,4,5,6-tetrafluoro-, 3,6-difluoro-, 3,4-difluoro-, 3-chloro-,
 35 4-chloro-, 3,6-dichloro-, 4,5-dichloro-, 3,4,5,6-tetrachloro-,
 4-bromo-, 3,4,5,6-tetrabromo-, 3,4,5,6-tetraiodo- and
 3-(4-bromo)phenyl-phthalic anhydride,
 -isatoic anhydrides such as isatoic anhydride, 6-methyl-,
 40 6-hydroxy-, 5-hydroxy-, 4-carboxy-, 4-nitro-, 5-nitro-, 5-amino-,
 6-fluoro-, 5-chloro-, 6-chloro-, 3,5-dichloro-, 5-bromo-,
 N-methyl-, N-ethyl-, N-benzyl-, N-allyl-, N-methyl-5-nitro-,
 N-methyl-5-chloro-, N-methyl-6-chloro- and
 N-methoxycarbamoylmethyl-isatoic anhydride, and also

-naphthalene-1,2-dicarboxylic and naphthalene-2,3-dicarboxylic anhydrides.

The present invention further provides copper complex dyes and 5 their mixtures which are obtainable by reacting dyes I with at least 0.1 mol equivalent of a copper donor. Preferably, 0.1 - 2 mol of a copper donor is used per mole of dye. Amounts above 2 mol equivalents are possible, but have no influence on the product. Incomplete formation of 2:1 complexes, i.e., the use of 10 < 2 mol equivalents of the copper donors, provides mixtures of the uncomplexed, singly copper-complexed and doubly copper-complexed dyes.

The copper complex dyes conform to the general formula VI in the 15 form of the free acid



where at least one of M^1 and M^2 is copper(II) and any which is not is hydrogen and methyl, and n , R^2 and A are each as defined above. When M^1 or M^2 is hydrogen and methyl, the methyl radical will form 30 the methoxy group on the phenyl ring and the hydrogen will form the hydroxyl group on the naphthalene structure.

Copper complex dyes obtained by reaction with 0.5 - 1.7 mol, especially 0.5 - 1.5 mol, of copper donor per mole of dye are 35 preferred.

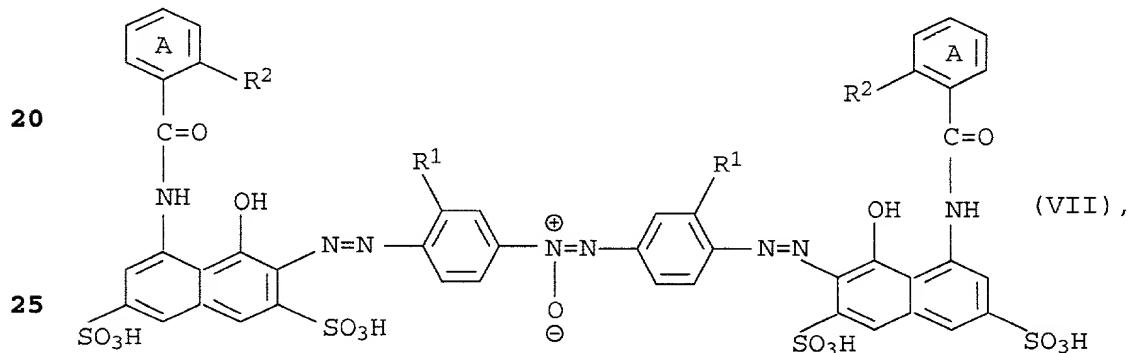
The copper donors used may be salts which contain the copper as cation, for example copper sulfate, copper chloride or copper acetate. In some cases, the use of complex copper compounds is of 40 advantage, for example in the form of copper-ammine complexes, such as coppertetrammine sulfates from copper sulfate and ammonia, pyridine or monoethanolamine, or in the form of compounds which contain the copper in complexed form, for example complex copper compounds of the alkali metal salts of aliphatic 45 aminocarboxylic acids or hydroxycarboxylic acids, as of

glycocol, of lactic acid and in particular of tartaric acid, such as sodium copper tartrate.

The treatment with the copper donor takes place in an aqueous or 5 organic/aqueous medium, for example at room temperature, if readily metallizable starting compounds are present, or by heating to 50 - 120°C in an open vessel, for example under reflux, or if necessary in a closed vessel under superatmospheric pressure, the pH conditions being determined by the nature of the 10 metallization method chosen.

If desired, solvents, for example alcohol, dimethylformamide, etc., can also be added during the metallization.

15 Preference is given to dyes of the general formula VII in the form of the free acid



where R¹, R² and A are each as defined above, and their copper complexes.

30

Preference is further given to dyes I where each R¹ is methoxy and to the copper complexes obtainable therefrom.

Preference is also given to dyes I and their copper complexes 35 where the phenyl rings A are unsubstituted, i.e., bear the R² only, or C₁-C₄-alkyl-substituted.

Preference is given to the dyes I and VII and their copper complexes where each R² is carboxyl.

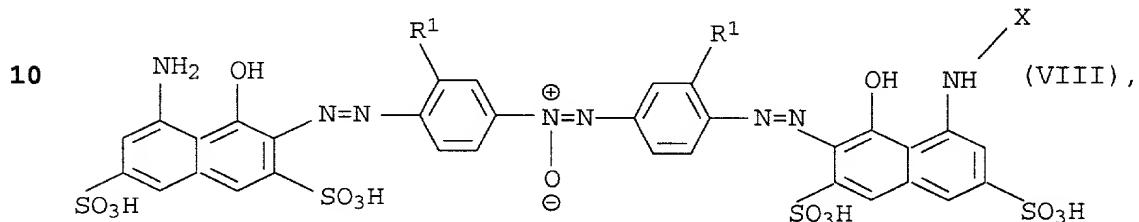
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Preference is given in particular to dyes I and VII where R¹ is methoxy, R² is carboxyl and the phenyl rings A bear C₁-C₄-alkyl as further substituents or preferably are unsubstituted. The copper complexes obtainable therefrom are preferred in particular.

45

Preference is given in particular to the copper complex mixture of the preferred dyes which are obtained by reaction with 0.1-2, especially 0.5-1.7, mol equivalents of a copper donor.

5 The present invention further provides azoxy dyes of the general formula VIII in the form of the free acid



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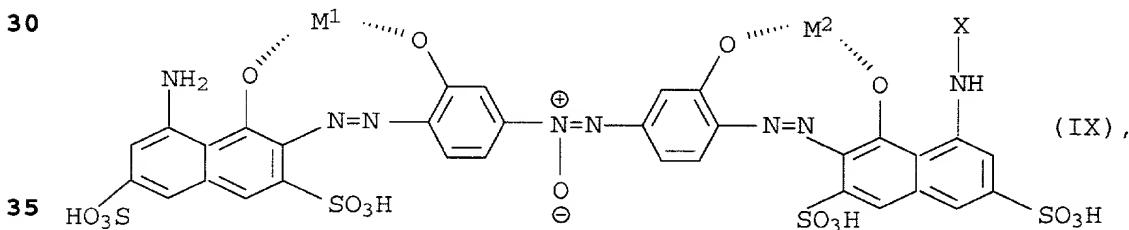
where X is hydrogen or a radical of the formula



and R¹, R² and A are each as defined above.

25

The present invention further provides copper complex dyes of the general formula IX in the form of the free acid



where M₁, M₂ and X are each as defined above.

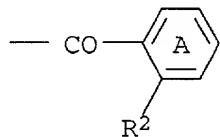
40 Preference is given to azoxy dyes of formula VIII in the form of the free acid where X is hydrogen.

Preference is further given to copper complex dyes of formula IX in the form of the free acid where X is hydrogen.

45

The azoxy dyes of the formula VIII are obtained as described above for the azoxy dyes of the formula I. The partial or complete detachment of the radical

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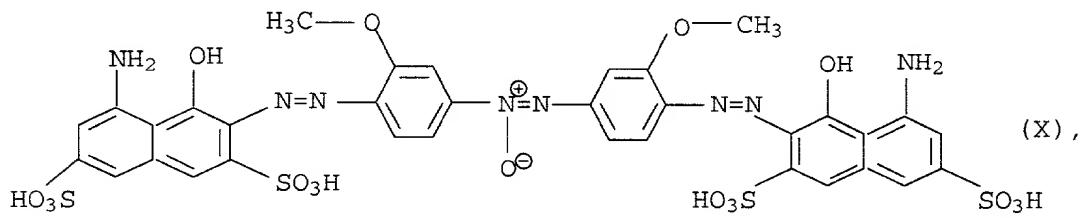


10 (deacylation) can be effected by controlling the pH after the reduction of the nitromonoazo dyes to the azoxy compound. Working in aqueous solution at a pH below 9 practically provides for complete deacylation to the azoxy dyes of the formula VIII (X = hydrogen).

15

The dye of the formula X

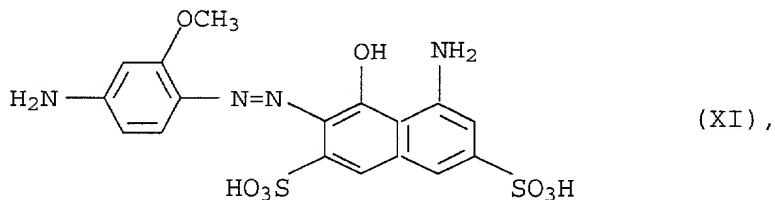
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is formally known from EP-A-648 814, where it is described in Example 3. However, it has been determined that, when this example is repeated, the monoazo dye of the formula XI

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35

is obtained instead of the abovementioned dye X.

40 The metal complex dyes of the invention can be used alone, in mixtures with each or one another and with the azoxy dyes I and VIII and together with other cationic or anionic compounds in the form of their solutions or in the form of powders or granules.

45 Dye preparations comprising the novel dyes of the formula I, VII, VIII and/or IX preferably further comprise polymers, such as polyvinylamines, polyvinylamides, polyvinyl acetates, polyvinyl

alcohols, polyvinylpyrrolidones or copolymers of the respective monomers. Similarly, oligomers of ethyleneimine, ethylene oxide or propylene oxide or derivatives thereof may be used. Further preferred additives are glycols such as 1,2-glycol,

5 1,2-propanediol, 2,3-butylene glycol, diethylene glycol, triethylene glycol, ethyltetraglycol, dipropylene glycol, ethylene glycol monopropyl ether, methyldiglycol, triethylene glycol monobutyl ether, triethylene glycol monopropyl ether, diethylene glycol monoethyl ether, diethylene glycol dibutyl

10 ether and particularly preferably urea.

They are very useful for dyeing or printing polymeric material, especially papery materials such as paper and paperboard, but also cellulose, cotton, leather, bast fibers, hemp, flax, sisal,

15 jute, coir, straw or anionically modified fibers and also in recording fluids such as inks especially for ink-jet or printing inks.

The dyes of the invention are particularly useful in the
20 production of pulp-dyed, sized and unsized paper. They are likewise useful for dyeing paper by the pulp method.

Paper, leather and cellulose are dyed in a conventional manner.

25 The copper complex dyes of the invention provide different bright blues. They have very good affinity for paper. The novel dyes and their preparations color the papermaking wastewater only minimally, if at all, which is particularly favorable from the aspect of keeping the water courses clean. They are substantive, 30 do not marble on paper and are substantially pH-insensitive. Dyeings on paper are notable for good lightfastness. On prolonged exposure to light the hue changes on-tone.

The dyed papers, which exhibit good bleachability, are wetfast, 35 not only with regard to water, but also with regard to milk, soapy water, sodium chloride solutions, fruit juices or sweetened mineral water, and are also stable to alcoholic drinks because of their good alcoholfastness.

40 The novel dyes can also be used for dyeing, padding or printing polyacrylonitrile textiles or anionically modified polyamide or polyester textiles.

The Examples which follow illustrate the invention.

45

Preparation of coupling components

Example 1

34.1 g of the monosodium salt of 1-amino-8-hydroxynaphthalene-3,6-disulfonic acid were introduced 5 into 250 g of water. A pH of 7-8 was set with 10% strength by weight sodium hydroxide solution. 19.3 g of phthalic anhydride were then added at 20-25°C, and 10% strength by weight sodium hydroxide solution was used to maintain the pH within the range from 7 to 8 during the subsequent stirring time of 3 h as well. 10 The completeness of the conversion of the 1-amino-8-hydroxynaphthalene-3,6-disulfonic acid was verified by means of thin layer chromatography. The coupling component solution thus prepared was used for dye synthesis without intermediate isolation.

15

Example 2

34.1 g of the monosodium salt of 1-amino-8-hydroxynaphthalene-3,6-disulfonic acid were introduced 20 into 300 g of water. A pH of 6-8 was set with 10% strength by weight sodium carbonate solution. 18 g of isatoic anhydride were then added at 20-30°C, and 10% strength by weight sodium carbonate solution was used to maintain the pH within the range from 6 to 8 during the subsequent stirring time overnight as well. The 25 completeness of the conversion of the 1-amino-8-hydroxynaphthalene-3,6-disulfonic acid was verified by means of thin layer chromatography. The coupling component solution thus prepared was used for dye synthesis without intermediate isolation.

30

Example 3

34.1 g of the monosodium salt of 1-amino-8-hydroxynaphthalene-3,6-disulfonic acid were introduced 35 into 200 g of water. A pH of 7-9 was set with 25% strength by weight potassium hydroxide solution. 26.5 g of 4-tert-butylphthalic anhydride were then added at 20-25°C, and 25% strength by weight potassium hydroxide solution was used to maintain the pH within the range from 7 to 9 during the 40 subsequent stirring time of 4 h as well. The completeness of the conversion of the 1-amino-8-hydroxynaphthalene-3,6-disulfonic acid was verified by means of thin layer chromatography. The coupling component solution thus prepared was used for dye synthesis without intermediate isolation.

45

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Example 4

34.1 g of the monosodium salt of 1-amino-8-hydroxynaphthalene-3,6-disulfonic acid were introduced **5** into 250 g of water. A pH of 7-8 was set with 10% strength by weight sodium hydroxide solution. 30.9 g of N-methoxycarbonylmethylisatoic anhydride were then added at 20-25°C, and 10% strength by weight sodium hydroxide solution was used to maintain the pH within the range from 7 to 8 during the **10** subsequent stirring time of 3 h as well. The completeness of the conversion of the 1-amino-8-hydroxynaphthalene-3,6-disulfonic acid was verified by means of thin layer chromatography. The coupling component solution thus prepared was used for dye synthesis without intermediate isolation.

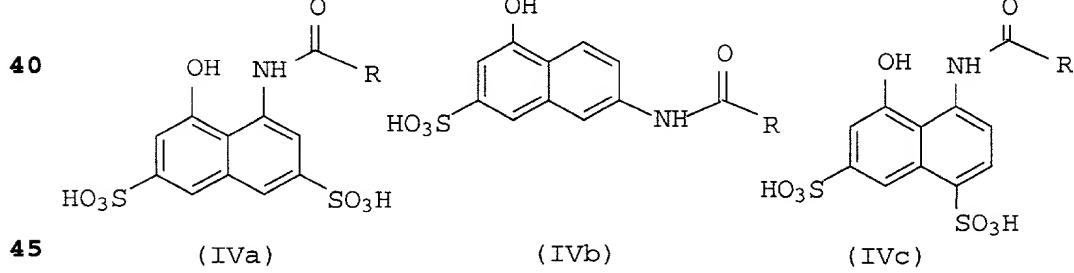
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Example 5

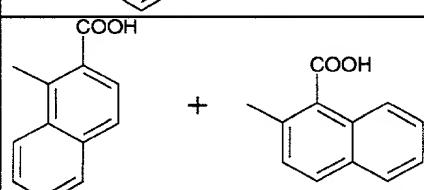
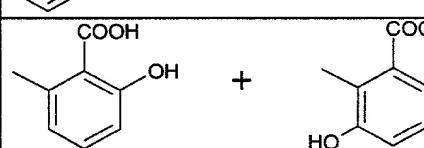
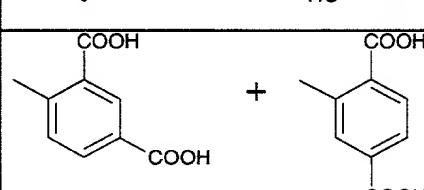
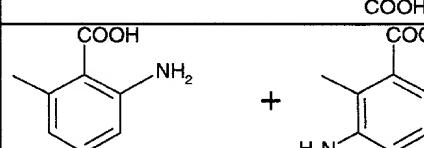
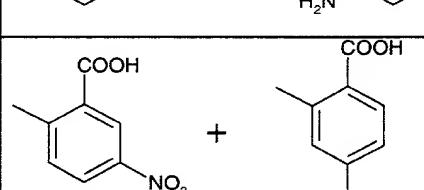
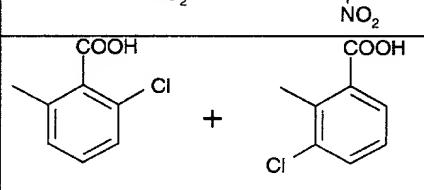
23.9 g of 3-amino-8-hydroxynaphthalene-6-sulfonic acid were introduced into 300 g of water. A pH of 7-8 was set with 10% **20** strength by weight sodium hydroxide solution. 20.8 g of phthalic anhydride were then added at 20-25°C, and 10% strength by weight sodium hydroxide solution was used to maintain the pH within the range from 7 to 8 during the subsequent stirring time overnight as well. The completeness of the conversion of the **25** 3-amino-8-hydroxynaphthalene-6-sulfonic acid was verified by means of thin layer chromatography. The coupling component solution thus prepared was used for dye synthesis without intermediate isolation.

30 Examples 1-5 are repeated with 1-amino-8-hydroxynaphthalene-3,6-disulfonic acid, 3-amino-8-hydroxynaphthalene-6-sulfonic acid and 1-amino-8-hydroxynaphthalene-4,6-disulfonic acid to prepare the coupling components of the general formulae Va, Vb and Vc **35** mentioned in Table 1.

Table 1:



Ex- ample	Naphthalene acid used	Anhydride used	—R
5	6	1-amino-8- hydroxy- naphthalene- 4,6-disul- fonic acid	phthalic anhy- dride
10	7	3-amino-8- hydroxy- naphthalene- 6-sulfonic acid	4-tertiary- butylphthalic anhydride
15	8	1-amino-8- hydroxy- naphthalene- 4,6-disul- fonic acid	4-tertiary- butylphthalic anhydride
20	9	1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	3,6-dimethyl- phthalic anhydride
25	10	3-amino-8- hydroxy- naphthalene- 6-sulfonic acid	3,6-dimethyl- phthalic anhydride
30	11	1-amino-8- hydroxy- naphthalene- 4,6-disul- fonic acid	3,6-dimethyl- phthalic anhydride
35	12	1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	3-methyl- phthalic anhydride
40	13	1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	4-methyl- phthalic anhydride
45	14	1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	3,4,5,6-tetra- methylphthalic anhydride

Ex- ample	Naphthalene acid used	Anhydride used	—R
5	15 1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	naphthalene- 2,3-dicarboxylic anhydride	
10	16 3-amino-8- hydroxy- naphthalene- 6-sulfonic acid	naphthalene- 2,3-di- carboxylic anhydride	
15	17 1-amino-8- hydroxy- naphthalene- 4,6-disul- fonic acid	naphthalene- 2,3-di- carboxylic anhydride	
20	18 1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	naphthalene- 1,2-di- carboxylic anhydride	
25	19 1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	3-hydroxy- phthalic anhydride	
30	20 1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	4-carboxy- phthalic anhydride	
35	21 1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	3-aminophthalic anhydride	
40	22 1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	4-nitrophthalic anhydride	
45	23 1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	3-chloro- phthalic anhydride	

Ex- ample	Naphthalene acid used	Anhydride used	—R
5 24	1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	4-bromophthalic anhydride	
10 25	3-amino-8- hydroxy- naphthalene- 6-sulfonic acid	isatoic anhydride	
15 26	1-amino-8- hydroxy- naphthalene- 4,6-disul- fonic acid	isatoic anhydride	
20 27	3-amino-8- hydroxy- naphthalene- 6-sulfonic acid	N-(methoxy- carbonylmethyl)- isatoic anhydride	
25 28	1-amino-8- hydroxy- naphthalene- 4,6-disul- fonic acid	N-(methoxy- carbonylmethyl)- isatoic anhydride	
30 29	1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	N-ethyl- isatoic anhydride	
35 30	1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	N-benzylisatoic anhydride	
40 31	1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	6-methylisatoic anhydride	
45 32	1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	6-hydroxyisatoic anhydride	
	33	1-amino-8- hydroxy- naphthalene- 3,6-disul- fonic acid	4-carboxyisatoic anhydride

Preparation of azoxy dyes according to the invention

Example 34

5 16.8 g of 2-methoxy-4-nitroaniline were precharged in 200 g of water and mixed with 30 g of concentrated hydrochloric acid. 32 ml of 23% strength by weight sodium nitrite solution were then added at 0-10°C over 30 minutes. After 2 h excess nitrite was destroyed with amidosulfonic acid and the diazo component thus prepared was added at 15-20°C over 20 minutes to the coupling component prepared in Example 1. The pH was maintained at 8-9 by the simultaneous addition of 20 ml of 25% by weight sodium hydroxide solution. After the coupling reaction had ended, 100 g of 50% strength by weight sodium hydroxide solution were metered in. At 40-45°C 47 g of 25% strength by weight glucose solution were gradually added dropwise with stirring. After the reaction had ended (TLC check), the dye was precipitated with 130 g of concentrated hydrochloric acid and isolated by filtration. The dye thus obtained dyes paper in a blue shade ($\lambda_{\text{max}} = 592 \text{ nm}$).

20

Example 35

16.8 g of 2-methoxy-4-nitroaniline were precharged in 200 g of water and mixed with 30 g of concentrated hydrochloric acid. 32 ml of 23% strength by weight sodium nitrite solution were then added at 0-10°C over 30 minutes. After 2 h excess nitrite was destroyed with amidosulfonic acid and the diazo component thus prepared was added at 15-20°C over 20 minutes to the coupling component prepared in Example 1. The pH was maintained at 8-9 by the simultaneous addition of 20 ml of 25% by weight sodium hydroxide solution. After the coupling reaction had ended, 20 g of 50% strength by weight sodium hydroxide solution were metered in. At 90°C 135 g of 10% strength by weight glucose solution were gradually added dropwise with stirring. After the reaction had ended (TLC check), the dye was precipitated with 80 g of concentrated hydrochloric acid and isolated by filtration.

Example 36

40 16.8 g of 2-methoxy-4-nitroaniline were precharged in 200 g of water and mixed with 30 g of concentrated hydrochloric acid. 32 ml of 23% strength by weight sodium nitrite solution were then added at 0-10°C over 30 minutes. After 2 h excess nitrite was destroyed with amidosulfonic acid and the diazo component thus prepared was added at 15-20°C over 20 minutes to the coupling component prepared in Example 1. The pH was maintained at 8-9 by the simultaneous addition of 20 ml of 25% by weight sodium

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hydroxide solution. After the coupling reaction had ended, 100 g of 50% strength by weight sodium hydroxide solution were metered in. At 60°C 44 g of 25% strength by weight glucose solution were gradually added dropwise with stirring. After the reaction had 5 ended (TLC check), the dye was precipitated with 130 g of concentrated hydrochloric acid and isolated by filtration.

Example 37

10 18.2 g of 5-nitroanthranilic acid were precharged in 290 g of water and mixed with 40 g of concentrated hydrochloric acid. 32 ml of 23% strength by weight sodium nitrite solution were then added at 0-10°C over 30 minutes. After 2 h excess nitrite was destroyed with amidosulfonic acid and the diazo component thus 15 prepared was added at 15-20°C over 20 minutes to the coupling component prepared in Example 1. The pH was maintained at 8-9 by the simultaneous addition of 200 ml of 10% by weight sodium hydroxide solution. After the coupling reaction had ended, 40 g of 50% strength by weight sodium hydroxide solution were metered 20 into the suspension. At 50°C 45 ml of 10% strength by weight glucose solution were gradually added dropwise with stirring. After the reaction had ended (TLC check), the dye was precipitated with concentrated hydrochloric acid and isolated by filtration. The dye thus obtained dyes paper in blue shades 25 ($\lambda_{\max} = 556$ nm).

Example 38

16.8 g of 2-methoxy-4-nitroaniline were precharged in 200 g of 30 water and mixed with 30 g of concentrated hydrochloric acid. 32 ml of 23% strength by weight sodium nitrite solution were then added at 0-10°C over 30 minutes. After 2 h excess nitrite was destroyed with amidosulfonic acid and the diazo component was adjusted with sodium acetate to pH 3-4. The coupling component 35 prepared in Example 2 was then added at 15-20°C over 20 minutes while the pH was adjusted to 4-5 with 10% strength by weight sodium hydroxide solution. The monoazo dye was isolated by filtration. The moist presscake was introduced into 1000 g of water and admixed with 100 g of 50% strength by weight sodium 40 hydroxide solution. At 60°C 45 ml of 25% strength by weight glucose solution were gradually added dropwise with stirring. After the reaction had ended (TLC check), the dye was precipitated with 150 g of concentrated hydrochloric acid and isolated by filtration. The dye thus obtained dyes paper in 45 reddish blue shades ($\lambda_{\max} = 544$ nm).

Example 39

16.8 g of 2-methoxy-4-nitroaniline were precharged in 200 g of water and mixed with 30 g of concentrated hydrochloric acid.

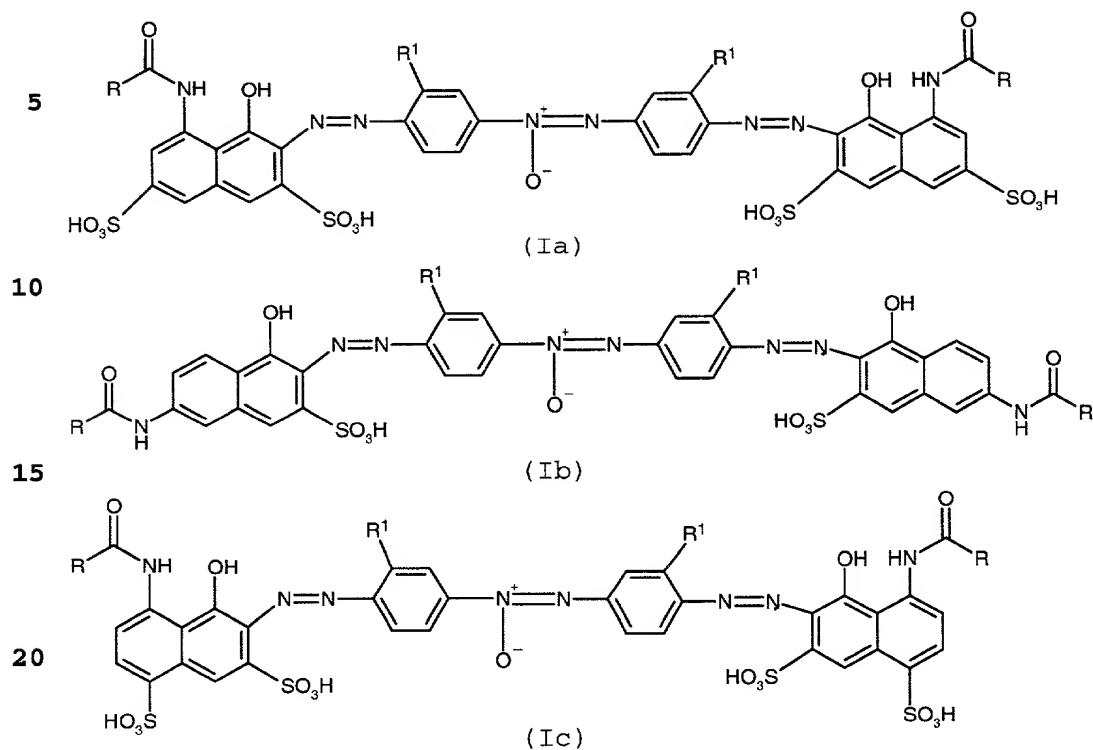
5 32 ml of 23% strength by weight sodium nitrite solution were then added at 0-10°C over 30 minutes. After 2 h excess nitrite was destroyed with amidosulfonic acid and the diazo component thus prepared was added at 15-20°C over 20 minutes to the coupling component prepared in Example 3. The pH was maintained at 8-9 by 10 the simultaneous addition of 10% by weight sodium hydroxide solution. After the coupling reaction had ended, 15 g of 50% strength by weight sodium hydroxide solution were metered in. At 65°C 115 ml of 15% strength by weight glucose solution were gradually added dropwise with stirring. After the reaction had 15 ended (TLC check), the dye was precipitated with concentrated hydrochloric acid and isolated by filtration. The dye thus obtained dyes paper in blue shades ($\lambda_{\text{max}} = 590$ nm).

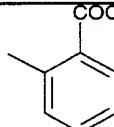
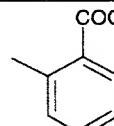
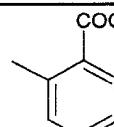
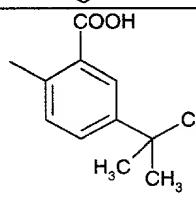
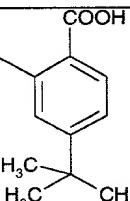
Example 40

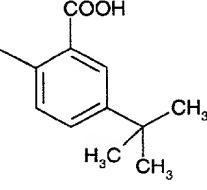
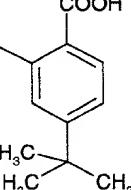
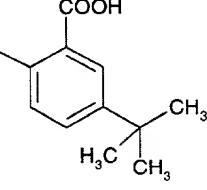
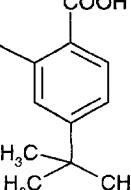
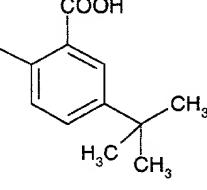
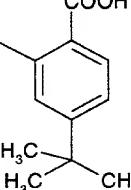
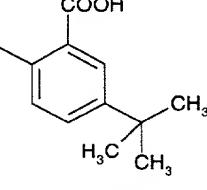
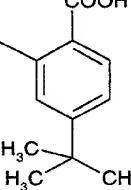
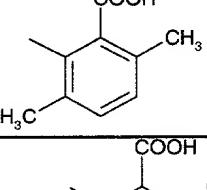
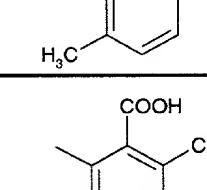
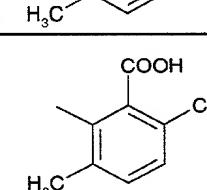
20 16.8 g of 2-methoxy-4-nitroaniline were precharged in 200 g of water and mixed with 30 g of concentrated hydrochloric acid. 32 ml of 23% strength by weight sodium nitrite solution were then added at 0-10°C over 30 minutes. After 2 h excess nitrite was 25 destroyed with amidosulfonic acid and the diazo component thus prepared was added at 15-20°C over 20 minutes to the coupling component prepared in Example 5. The pH was maintained at 8-9 by the simultaneous addition of 20 ml of 25% by weight sodium hydroxide solution. After the coupling reaction had ended, 25 g 30 of 50% strength by weight sodium hydroxide solution were metered in. At 60°C 130 g of 10% strength by weight glucose solution were gradually added dropwise with stirring. After the reaction had ended (TLC check), the dye was precipitated with 130 g of concentrated hydrochloric acid and isolated by filtration. The 35 dye thus obtained dyes paper in a blue shade ($\lambda_{\text{max}} = 584$ nm).

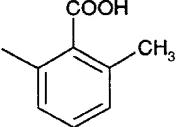
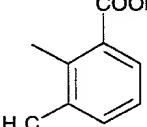
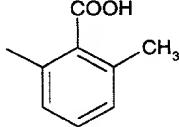
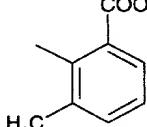
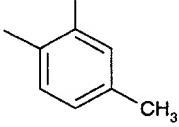
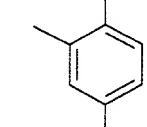
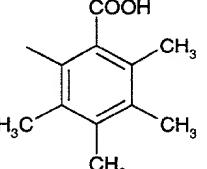
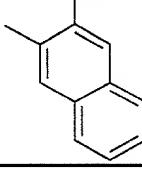
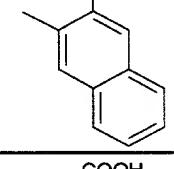
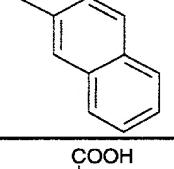
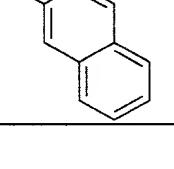
Examples 34 - 40 were repeated to prepare the dyes of the general formulae Ia, Ib and Ic mentioned in Table 2. The choice of the best reduction conditions is adjusted to the nature of the 40 nitroazo compound to be used and is easy to determine in preliminary experiments. The dyes thus obtained can be isolated by adding hydrochloric acid or dyed up on paper from the reaction suspension.

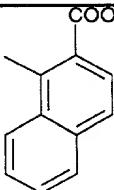
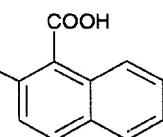
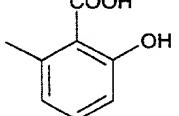
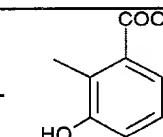
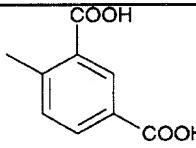
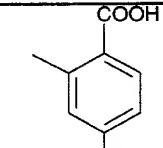
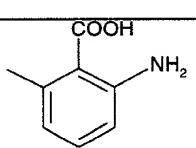
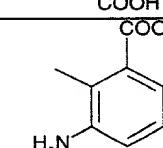
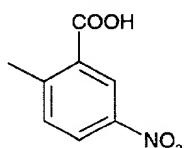
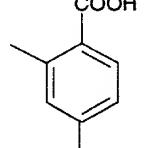
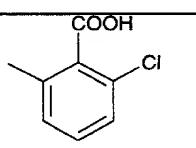
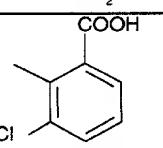
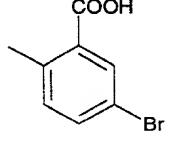
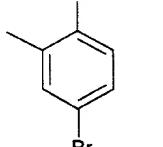
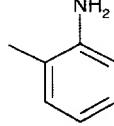
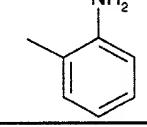
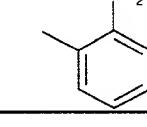
Table 2:

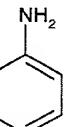
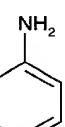
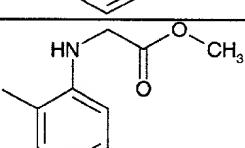
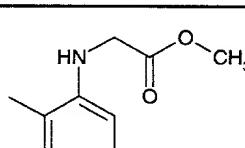
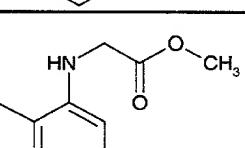
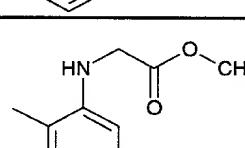
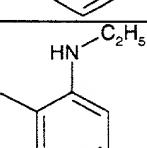
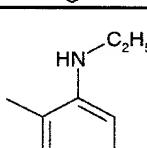
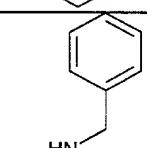


Ex.	Diazo component	Coupling component from	For-mula	R ¹	-R
41	5-nitro-anthra-nilic acid	Ex. 5	Ib	COOH	
42	2-methoxy-4-nitro-aniline	Ex. 6	Ic	OCH ₃	
43	5-nitro-anthra-nilic acid	Ex. 6	Ic	COOH	
44	5-nitro-anthra-nilic acid	Ex. 3	Ia	COOH	 + 

Ex.	Diazo component	Coupling component from	For- mula	R ¹	-R
5	45 2-methoxy-4-nitro-aniline	Ex. 7	Ib	OCH ₃	 + 
10	46 5-nitro-anthra-nilic acid	Ex. 7	Ib	COOH	 + 
15	47 2-methoxy-4-nitro-aniline	Ex. 8	Ic	OCH ₃	 + 
20	48 5-nitro-anthra-nilic acid	Ex. 8	Ic	COOH	 + 
25	49 2-methoxy-4-nitro-aniline	Ex. 9	Ia	OCH ₃	
30	50 5-nitro-anthra-nilic acid	Ex. 9	Ia	COOH	
35	51 2-methoxy-4-nitro-aniline	Ex. 10	Ib	OCH ₃	
40	52 2-methoxy-4-nitro-aniline	Ex. 11	Ic	OCH ₃	

Ex.	Diazo component	Coupling component from	For- mula	R ¹	-R
5	2-methoxy-4-nitro-aniline	Ex. 12	Ia	OCH ₃	 + 
10	5-nitro-anthra-nilic acid	Ex. 12	Ia	COOH	 + 
15	2-methoxy-4-nitro-aniline	Ex. 13	Ia	OCH ₃	 + 
20	2-methoxy-4-nitro-aniline	Ex. 14	Ia	OCH ₃	
25	2-methoxy-4-nitro-aniline	Ex. 15	Ia	OCH ₃	
30	5-nitro-anthra-nilic acid	Ex. 15	Ia	COOH	
35	2-methoxy-4-nitro-aniline	Ex. 16	Ib	OCH ₃	
40	2-methoxy-4-nitro-aniline	Ex. 17	Ic	OCH ₃	
45					

Ex.	Diazo component	Coupling component from	For- mula	R ¹	-R
5	61 2-methoxy-4-nitro-aniline	Ex. 18	Ia	OCH ₃	 + 
10	62 2-methoxy-4-nitro-aniline	Ex. 19	Ia	OCH ₃	 + 
15	63 2-methoxy-4-nitro-aniline	Ex. 20	Ia	OCH ₃	 + 
20	64 2-methoxy-4-nitro-aniline	Ex. 21	Ia	OCH ₃	 + 
25	65 2-methoxy-4-nitro-aniline	Ex. 22	Ia	OCH ₃	 + 
30	66 2-methoxy-4-nitro-aniline	Ex. 23	Ia	OCH ₃	 + 
35	67 2-methoxy-4-nitro-aniline	Ex. 24	Ia	OCH ₃	 + 
40	68 5-nitro-anthra-nilic acid	Ex. 2	Ia	COOH	
45	69 2-methoxy-4-nitro-aniline	Ex. 25	Ib	OCH ₃	
	70 5-nitro-anthra-nilic acid	Ex. 25	Ib	COOH	

Ex.	Diazo component	Coupling component from	For-mula	R ¹	-R
5	71 2-methoxy-4-nitro-aniline	Ex. 26	Ic	OCH ₃	
10	72 5-nitro-anthra-nilic acid	Ex. 26	Ic	COOH	
15	73 2-methoxy-4-nitro-aniline	Ex. 4	Ia	OCH ₃	
20	74 5-nitro-anthra-nilic acid	Ex. 4	Ia	COOH	
25	75 2-methoxy-4-nitro-aniline	Ex. 27	Ib	OCH ₃	
30	76 2-methoxy-4-nitro-aniline	Ex. 28	Ic	OCH ₃	
35	77 2-methoxy-4-nitro-aniline	Ex. 29	Ia	OCH ₃	
40	78 5-nitro-anthra-nilic acid	Ex. 29	Ia	COOH	
45	79 2-methoxy-4-nitro-aniline	Ex. 30	Ia	OCH ₃	

	Ex.	Diazo component	Coupling component from	For-mula	R ¹	-R
5	80	2-methoxy-4-nitro-aniline	Ex. 31	Ia	OCH ₃	
10	81	2-methoxy-4-nitro-aniline	Ex. 32	Ia	OCH ₃	
15	82	2-methoxy-4-nitro-aniline	Ex. 33	Ia	OCH ₃	

Synthesis of copper complexes according to invention

20

Copper complexes are prepared according to methods known in principle:

The dealkylating coppering of o-hydroxy-o'-methoxy-azo dyes

25 generally takes 6-12 hours of heating at 80-90°C in an ammoniacal medium. Ammonia may be wholly or partly replaced with organic nitrogenous bases. Coppering can be performed starting from the isolated dyes or be carried out immediately following the reduction, in which case the copperless dyes are not isolated in

30 between. If the copperless dye was isolated, both the moist presscake and the dried dye can be used. The ratio of copperless dye to singly coppered dye to doubly coppered dye depends on the amount of copper salt provided. The dyes thus prepared are partly precipitated with hydrochloric acid and partly dyed up on paper

35 directly from the reaction solution. The dyes can be obtained as stable liquid formulations in the form of their salts (e.g., lithium, sodium, potassium; (optionally substituted) ammonium) by means of customary methods.

40 Example 83

1/5 of the isolated dye prepared according to Example 34 was slurried up in 250 g of water and admixed with 5.5 g of diethanolamine and 0.75 g of copper(II) sulfate pentahydrate. The

45 pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that

24

pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 598$ nm).

Example 84

5

1/5 of the isolated dye prepared according to Example 34 was slurried up in 250 g of water and admixed with 5.5 g of diethanolamine and 1.25 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium **10** hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 600$ nm).

Example 85

15

1/5 of the isolated dye prepared according to Example 34 was slurried up in 250 g of water and admixed with 5.5 g of diethanolamine and 1.75 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium **20** hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 602$ nm).

Example 86

25

1/5 of the isolated dye prepared according to Example 34 was slurried up in 250 g of water and admixed with 5.5 g of diethanolamine and 2.25 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium **30** hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 606$ nm).

Example 87

35

1/5 of the isolated dye prepared according to Example 34 was slurried up in 250 g of water and admixed with 5.5 g of diethanolamine and 2.75 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium **40** hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 610$ nm).

45

Example 88

1/5 of the isolated dye prepared according to Example 34 was slurried up in 250 g of water and admixed with 5.5 g of

5 diethanolamine and 3.25 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{max} = 614$ nm).

10

Example 89

1/5 of the isolated dye prepared according to Example 34 was slurried up in 250 g of water and admixed with 5.5 g of

15 diethanolamine and 3.75 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{max} = 618$ nm).

20

Example 90

1/5 of the isolated dye prepared according to Example 34 was slurried up in 250 g of water and admixed with 5.5 g of

25 diethanolamine and 4.25 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{max} = 618$ nm).

30

Example 91

1/5 of the isolated dye prepared according to Example 34 was slurried up in 250 g of water and admixed with 5.5 g of

35 diethanolamine and 4.5 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{max} = 624$ nm).

40

Example 92

1/5 of the isolated dye prepared according to Example 34 was slurried up in 250 g of water and admixed with 5.5 g of

45 diethanolamine and 5 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that

26

pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 626$ nm).

Example 93

5

The dyes prepared in Examples 34, 83, 84, 85, 86, 87, 88, 89, 90, 91 and 92 are pulp-dyed up in a conventional manner onto various papery material models to 1/6 standard depth of shade. It is found that the hue of the dyes becomes greener in the stated

10 order and that the lightfastness increases.

Example 94

1/5 of the reaction suspension of the dye prepared according to

15 Example 34 was diluted with 170 g of water and admixed with 5.5 g of diethanolamine and 2.75 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a 20 blue shade ($\lambda_{\max} = 602$ nm).

Example 95

1/5 of the reaction suspension of the dye prepared according to

25 Example 34 was diluted with 170 g of water and admixed with 5.5 g of diethanolamine and 5.2 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a 30 blue shade ($\lambda_{\max} = 608$ nm).

Example 96

3/5 of the isolated dye prepared according to Example 34 was

35 slurried up in 750 g of water and admixed with 16.5 g of diethanolamine and 7.8 g of copper acetate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that pH and 80°C for 8 h. The dye thus obtained dyes paper in a blue shade 40 ($\lambda_{\max} = 614$ nm).

Example 97

1/5 of the isolated dye prepared according to Example 34 was

45 slurried up in 155 g of water and admixed with 5.5 g of diethanolamine and 2.6 g of copper acetate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide

solution. The reaction mixture was then stirred at that pH and 80°C for 8 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 612$ nm).

5 Example 98

1/5 of the reaction suspension of the dye prepared according to Example 39 was diluted with 140 g of water and admixed with 5.5 g of diethanolamine and 6 g of copper(II) sulfate pentahydrate. The 10 reaction mixture was then stirred at 85°C for 6 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 620$ nm).

Example 99

15 1/5 of the reaction suspension of the dye prepared according to Example 39 was diluted with 140 g of water and admixed with 18 g of 25% strength ammonia and 6 g of copper(II) sulfate pentahydrate. The reaction mixture was then stirred at 85°C for 6 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 604$ 20 nm).

Example 100

1/5 of the reaction suspension of the dye prepared according to 25 Example 40 was diluted with 140 g of water and admixed with 5.5 g of diethanolamine and 6 g of copper(II) sulfate pentahydrate. The reaction mixture was then stirred at 85°C for 6 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 588$ nm).

30 Example 101

1/5 of the reaction suspension of the dye prepared according to Example 40 was diluted with 140 g of water and admixed with 18 g of 25% strength ammonia and 6 g of copper(II) sulfate 35 pentahydrate. The reaction mixture was then stirred at 85°C for 6 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 586$ nm).

Example 102

40

2/5 of the isolated dye prepared according to Example 38 was slurried up in 365 g of water and admixed with 11 g of diethanolamine and 10 g of copper(II) sulfate pentahydrate. The reaction mixture was then stirred at 85°C for 6 h. The dye thus 45 obtained dyes paper in a blue shade.

Half the batch was bottled as reaction suspension. ($\lambda_{\max} = 564$ nm).

The other half of the batch was admixed with 25 g of concentrated hydrochloric acid and the precipitated dye was filtered off, washed with sodium chloride solution and then dried under reduced pressure at 50-60°C. ($\lambda_{\text{max}} = 546 \text{ nm}$).

5

Example 103

2/5 of the isolated dye prepared according to Example 38 was slurried up in 365 g of water and admixed with 36 g of 25%

10 strength ammonia and 10 g of copper(II) sulfate pentahydrate. The reaction mixture was then stirred at 85°C for 6 h. The dye thus obtained dyes paper in a blue shade.

Half the batch was bottled as reaction suspension. ($\lambda_{\text{max}} = 564 \text{ nm}$).

15 The other half of the batch was admixed with 25 g of concentrated hydrochloric acid and the precipitated dye was filtered off, washed with sodium chloride solution and then dried under reduced pressure at 50-60°C. ($\lambda_{\text{max}} = 546 \text{ nm}$).

20 Examples 83 - 103 were repeated to convert the azoxy dyes of Examples 41-82, depending on the conditions recited in Table 3, into dye mixtures comprising the uncomplexed, singly copper-complexed and doubly copper-complexed azoxy dye, which dye paper uniformly and have good fastnesses. The choice of the best

25 reaction conditions (pH, temperature, reaction time) is adjusted to the nature of the dye to be used and is easily determined in preliminary experiments. The dyes thus obtained can be isolated by adding an acid or be dyed up on paper from the reaction suspension.

30

Table 3:

Example	Azoxy dye	Moles of Cu salt per mole of dye
104	Example 42	1
35	105	2
	106	1
	107	1.5
	108	2
40	109	2
	110	2
	111	2
	112	2
	113	2
45	114	2
	115	2
	116	2
	117	2
	118	2
	119	2

Example	Azoxy dye	Moles of Cu salt per mole of dye
120	Example 66	2
121	Example 69	1
5 122	Example 69	2
123	Example 71	2
124	Example 73	1
125	Example 73	2
126	Example 75	2
127	Example 77	2
10 128	Example 80	2

The copper complexes of water-soluble o-hydroxy-o'-carboxy-azo dyes are formed under mild conditions at room temperature in the weakly acidic or ammoniacal pH range. On an industrial scale, 15 elevated temperatures are used for solubility reasons. When the metallization is carried out in the acidic range, the liberated mineral acid is buffered off with sodium acetate. With this class of compounds too the coppering can be conducted starting from the isolated dyes or be carried out directly following the reduction, 20 in which case the copperless dyes are not intermediately isolated. If the copperless dye was isolated, both the moist presscake and the dried dye can be used. The ratio of copperless dye to singly coppered dye to doubly coppered dye depends on the amount of copper salt provided. The dyes thus prepared are partly 25 precipitated with hydrochloric acid and partly dyed up on paper directly from the reaction solution. The dyes can be obtained as stable liquid formulations in the form of their salts (e.g., lithium, sodium, potassium; (optionally substituted) ammonium) by means of customary methods.

30 Example 129

1/5 of the isolated dye prepared according to Example 37 was slurried up in 150 g of water and admixed with 10 g of 35 diethanolamine and 5 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 10 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at 90°C for 8 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 574$ nm).

40 Example 130

1/5 of the isolated dye prepared according to Example 37 was slurried up in 150 g of water and admixed with 4.5 g of 25% strength ammonia and 5 g of copper(II) sulfate pentahydrate. The 45 pH was then adjusted to 9.5 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at 90°C

for 8 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 576$ nm).

Example 131

5

1/5 of the isolated dye prepared according to Example 37 was slurried up in 150 g of water and admixed with 5 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 4 using 10% strength by weight sodium hydroxide solution. The reaction

10 mixture was then stirred at 90°C for 8 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\max} = 602$ nm).

Examples 129 - 131 were repeated to convert the azoxy dyes of Examples 41-82, depending on the conditions recited in Table 4, 15 into dye mixtures comprising the uncomplexed, singly copper-complexed and doubly copper-complexed azoxy dye, which dye paper uniformly and have good fastnesses. The choice of the best reaction conditions (pH, temperature, reacion time) is adjusted to the nature of the dye to be used and is easily determined in 20 preliminary experiments. The dyes thus obtained can be isolated by adding an acid or be dyed up on paper from the reaction suspension.

Table 4:

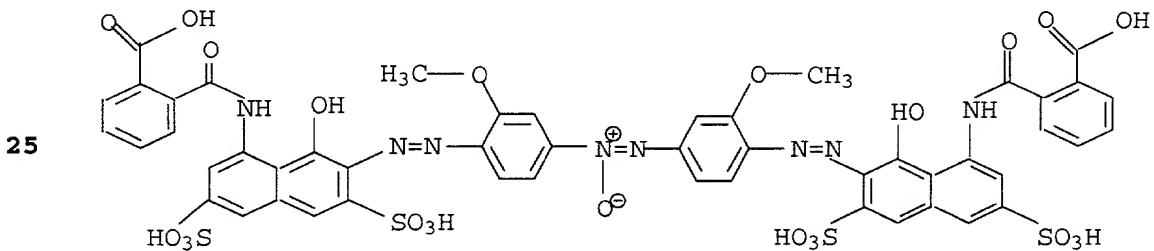
25	Example	Azoxy dye	Moles of Cu salt per mole of dye
	132	Example 37	1
	133	Example 41	1
	134	Example 41	2
30	135	Example 43	1
	136	Example 43	2
	137	Example 44	2
	138	Example 46	2
	139	Example 48	2
	140	Example 50	2
35	141	Example 54	2
	142	Example 58	2
	143	Example 68	1
	144	Example 68	1.5
	145	Example 68	2
40	146	Example 70	2
	147	Example 72	2
	148	Example 74	2
	149	Example 78	2

Example 150

16.8 g of 2-methoxy-4-nitroaniline were precharged in 200 g of water and admixed with 30 g of concentrated hydrochloric acid.

5 32 ml of 23% strength by weight sodium nitrite solution were then added at 0-10°C over 30 minutes. After 2 h excess nitrite was destroyed with amidosulfonic acid and the diazo component thus prepared was added at 15-20°C over 20 minutes to the coupling component prepared in Example 1. The pH was maintained at 8-9 by 10 the simultaneous addition of 20 ml of 25% strength by weight sodium hydroxide solution. After the coupling reaction had ended, 75 g of 50% strength by weight sodium hydroxide solution were metered in. At 40-45°C 47.5 g of 25% strength by weight glucose solution were gradually added dropwise with stirring. After the 15 reaction had ended (TLC check), the dye was adjusted with 79 g of concentrated hydrochloric acid and stirred at 60°C for 6 h. 19 g of concentrated hydrochloric acid were then added to adjust the pH to 2.2 and, after cooling of the suspension, the dye was isolated by filtration. The dye thus obtained of the formula

20



30 dyes paper in a blue shade ($\lambda_{\max} = 596$ nm).

Example 151

1/5 of the isolated dye prepared according to Example 150 was 35 slurried up in 155 g of water and admixed with 5.5 g of diethanolamine and 2.25 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue 40 shade ($\lambda_{\max} = 606$ nm).

Example 152

1/5 of the isolated dye prepared according to Example 150 was 45 slurried up in 155 g of water and admixed with 5.5 g of diethanolamine and 3.25 g of copper(II) sulfate pentahydrate. The pH was then adjusted to 8.5-9 using 10% strength by weight sodium

hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\text{max}} = 618$ nm).

5 Example 153

2/5 of the isolated dye prepared according to Example 150 was slurried up in 310 g of water and admixed with 11 g of diethanolamine and 8.5 g of copper(II) sulfate pentahydrate. The 10 pH was then adjusted to 8.5-9 using 10% strength by weight sodium hydroxide solution. The reaction mixture was then stirred at that pH and 90°C for 7 h. The dye thus obtained dyes paper in a blue shade ($\lambda_{\text{max}} = 626$ nm).

15 Example 154

16.8 g of 2-methoxy-4-nitroaniline were precharged in 150 g of water and admixed with 30 g of concentrated hydrochloric acid. 32 ml of a 23% strength by weight sodium nitrite solution were 20 then added at 0-10°C over 30 minutes. After 2 h excess nitrite was destroyed with amidosulfonic acid and the diazo component thus prepared was added at 15-20°C over 30 minutes to the coupling component prepared in Example 1. The pH was maintained at about 9 by the simultaneous addition of 20 ml of 25% strength by weight 25 sodium hydroxide solution. After the coupling reaction had ended, 40 g of 50% strength by weight sodium hydroxide solution were metered in. At 50-55°C 12.3 g of glucose were added a little at a time. After the reaction had ended (TLC check) the pH was adjusted to 8 by addition of 33 g of concentrated hydrochloric 30 acid and the reaction mixture was stirred at 90°C for 2 h. At that point, amide cleavage was complete. After cooling to room temperature the pH was adjusted to 8 by addition of 5 g of 50% strength by weight sodium hydroxide solution and the dye was isolated by filtration. The dye thus obtained dyes paper in a 35 blue shade ($\lambda_{\text{max}} = 598$ nm).

Example 155

1/5 of the isolated dye prepared according to Example 154 was 40 slurried up in 110 g of water and admixed with 3.7 g of ethanolamine. 2.25 g of copper(II) sulfate pentahydrate dissolved in 25 g of water were added at 50°C and the reaction mixture was stirred at 90°C and pH 8.5-9.5 for 7 h. The dye mixture thus obtained dyes paper in a blue shade ($\lambda_{\text{max}} = 606$ nm).

Example 156

1/5 of the isolated dye prepared according to Example 154 was slurried up in 97 g of water by addition of 13 g of urea. 2.25 g 5 of copper(II) sulfate pentahydrate dissolved in 25 g of water were added at 50°C and the reaction mixture was stirred at 90°C and pH 8.5-9.5 for 7 h. The dye mixture thus obtained dyes paper in a blue shade ($\lambda_{\max} = 606$ nm).

10 Example 157

1/5 of the isolated dye prepared according to Example 154 was slurried up in 110 g of water and admixed with 3.7 g of ethanolamine. 2.75 g of copper(II) sulfate pentahydrate dissolved 15 in 25 g of water were added at 50°C and the reaction mixture was stirred at 90°C and pH 8.5-9.5 for 7 h. The dye mixture thus obtained dyes paper in a blue shade ($\lambda_{\max} = 606$ nm).

Example 158

20

1/5 of the isolated dye prepared according to Example 154 was slurried up in 97 g of water by addition of 13 g of urea and admixed with 3.7 g of ethanolamine. 2.75 g of copper(II) sulfate pentahydrate dissolved in 25 g of water were added at 50°C and the 25 reaction mixture was stirred at 90°C and pH 8.5-9.5 for 7 h. The dye mixture thus obtained dyes paper in a blue shade ($\lambda_{\max} = 606$ nm).

30

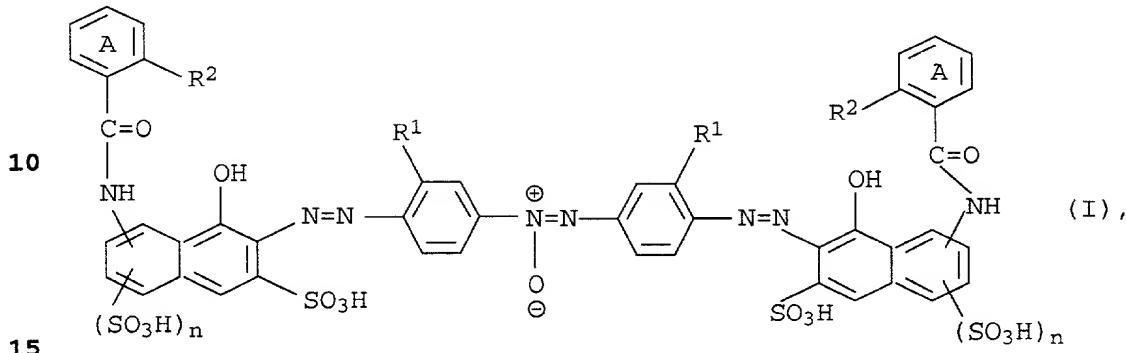
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We claim:-

1. Azoxy dyes of the general formula I in the form of the free acid



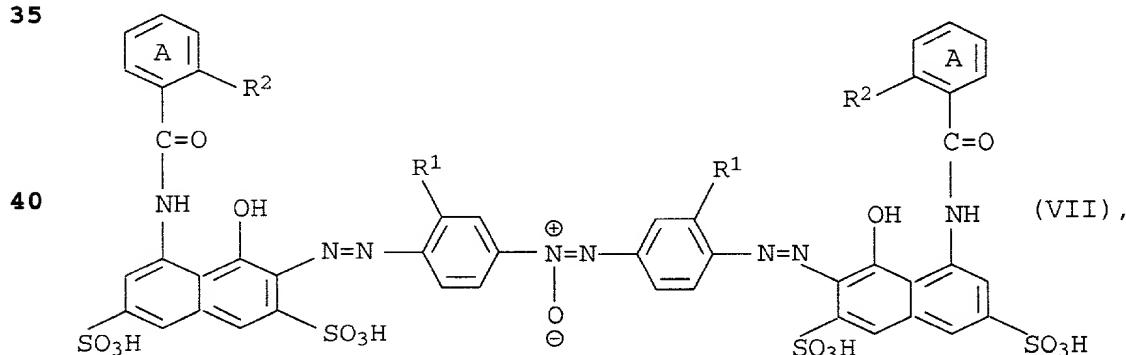
where

n is 0 or 1, each

20 R¹ is selected from the group consisting of methoxy, hydroxyl and carboxyl, each

25 R² is selected from the group consisting of carboxyl, amino, C₁-C₄-alkylamino, allylamino, benzylamino and methoxycarbonylmethylamino, and the phenyl rings A may additionally be substituted by C₁-C₈-alkyl, unsubstituted or methyl- or halogen-substituted phenyl, hydroxyl, amino, nitro, halogen, carboxyl, N-benzylcarbamoyl, unsubstituted or nitro-, halogen-, C₁-C₄-alkoxy- or 30 acetoxy-substituted phenylcarbamoyl and naphthylcarbamoyl or be benzofused.

2. Azoxy dyes as claimed in claim 1 of the general formula VII in the form of the free acid



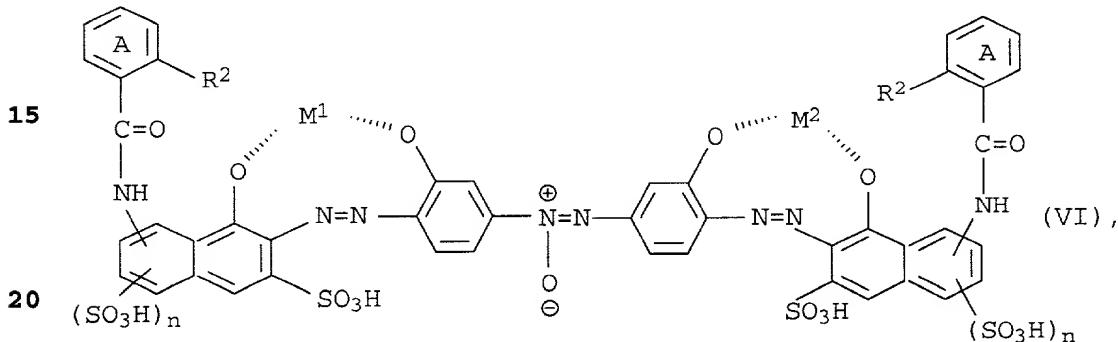
45 where R¹, R² and A are each as defined in claim 1.

3. Azoxy dyes as claimed in claim 1 or 2, wherein each R¹ is methoxy.

4. Azoxy dyes as claimed in any of claims 1 to 3, wherein the phenyl rings A are unsubstituted or C₁-C₄-alkyl-substituted.

5. Azoxy dyes as claimed in any of claims 1 to 4, wherein each R² is carboxyl.

10 6. Copper complex dyes of the general formula VI in the form of the free acid



where at least one of M¹ and M² is copper(II) and any which is not is hydrogen and methyl, and n, R² and A are each as defined in claim 1, and mixtures thereof.

7. Copper complex dyes and their mixtures obtainable by reacting the dyes of any of claims 1 to 6 with at least 0.1 mol equivalent of a copper donor.

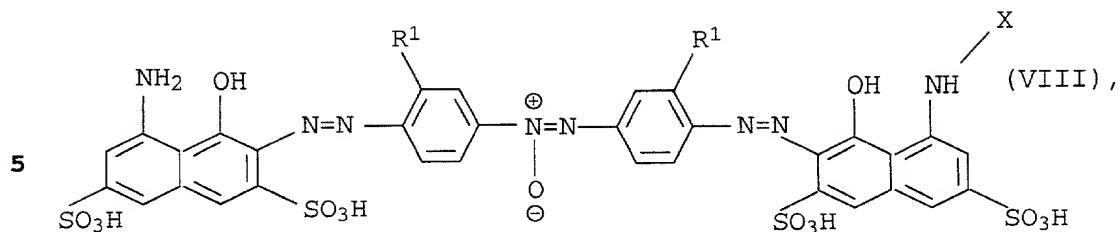
30

8. A process for preparing copper complex dyes, which comprises reacting an azoxy dye of any of claims 1 to 5 with at least 0.1 mol equivalent of a copper donor.

35 9. A method of using one or more azoxy dyes and/or their copper complexes of any of claims 1 to 7 for dyeing or printing natural or synthetic substrates.

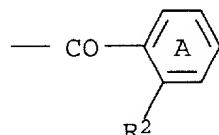
10. Natural or synthetic substrates dyed or printed with one or 40 more azoxy dyes and/or their copper complexes of any of claims 1 to 7.

11. Azoxy dyes of the general formula VIII in the form of the free acid



where

10 X is hydrogen or a radical of the formula



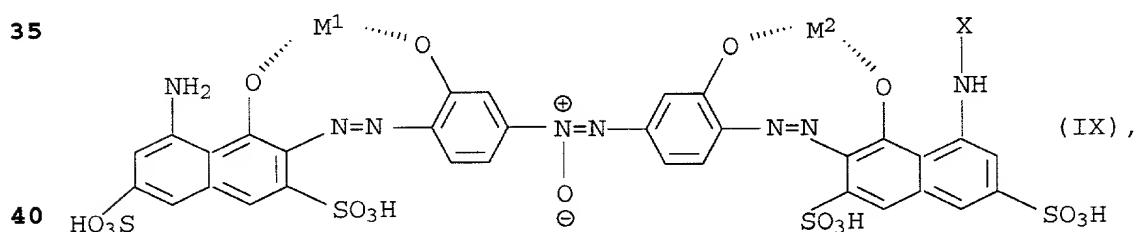
R¹ is selected from the group consisting of methoxy, hydroxyl and carboxyl,

20 R² is selected from the group consisting of carboxyl, amino, C₁-C₄-alkylamino, allylamino, benzylamino and methoxycarbonylmethylamino and the phenyl ring A may additionally be substituted by substituents selected from the group consisting of C₁-C₈-alkyl, unsubstituted phenyl, methyl-substituted phenyl, halogen-substituted phenyl, hydroxyl, amino, nitro, halogen, carboxyl, N-benzylcarbamoyl, unsubstituted or nitro-, halogen-, C₁-C₄-alkoxy- or acetoxy-substituted phenylcarbamoyl and naphthylcarbamoyl or may be benzofused.

25

30

12. Copper complex dyes of the general formula IX in the form of the free acid



45 where at least one of M¹ and M² is copper(II) and any which is not is selected from the group consisting of hydrogen and methyl and X is as defined in claim 11, and mixtures thereof.

Declaration, Power of Attorney

Page 1 of 3

0050/049829

We (I), the undersigned inventor(s), hereby declare(s) that:

My residence, post office address and citizenship are as stated below next to my name,

We (I) believe that we are (I am) the original, first, and joint (sole) inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled

the specification of which

[] is attached hereto.

[] was filed on _____ as

Application Serial No. _____

and amended on _____.

[x] was filed as PCT international application

Number _____ PCT/EP00/01636

on _____ February 28, 2000

and was amended under PCT Article 19

on _____ (if applicable).

We (I) hereby state that we (I) have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We (I) acknowledge the duty to disclose information known to be material to the patentability of this application as defined in Section 1.56 of Title 37 Code of Federal Regulations.

We (I) hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed. Prior Foreign Application(s)

Application No.	Country	Day/Month/Year	Priority Claimed
19911267.3	Germany	13 March 1999	[x] Yes [] No

We (I) hereby claim the benefit under Title 35, United States Codes, § 119(e) of any United States provisional application(s) listed below.

(Application Number)

(Filing Date)

(Application Number)

(Filing Date)

We (I) hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

Application Serial No.

Filing Date

**Status (pending, patented,
abandoned)**

And we (I) hereby appoint:

Norman F. Oblon, Registration Number 24, 618;
Marvin J. Spivak Registration Number 24, 913;
Gregory J. Maier, Registration Number 25, 599;
William E. Beaumont, Registration Number 30, 996;
Steven B. Kelber, Registration Number 30, 073;
Jean-Paul Lavalleye, Registration Number 31, 451;
Timothy R. Schwartz, Registration Number 32, 171;
Stephen G. Baxter, Registration Number 32, 884;
Richard L. Treanor, Registration Number 36, 379;
Robert W. Hahl, Registration Number 33, 893 our (my) a

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Robert W. Hamm, Registration Number 5,823, our (my) attorneys, with full powers of substitution and revocation, to prosecute this application and to transact all business in the Patent Office connected therewith; and we (I) hereby request that all correspondence regarding this application be sent to the firm of **OBLON, SPIVAK, McCLELLAND, MAIER & NEUSTADT, P. C.**, whose Post Office Address is: Fourth Floor, 1755 Jefferson Davis Highway, Arlington, Virginia 22202.

We (I) declare that all statements made herein of our (my) own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Declaration

Page 3 of 3

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Rainer Tresch
NAME OF INVENTOR

Rainer Tresch

Signature of Inventor

Date March 16, 2000

Nibelungenweg 5
67133 Maxdorf
Germany *DEX*
Citizen of: Germany
Post Office Address: same as residence

Karl-Heinz Etzbach
NAME OF INVENTOR

Karl-Heinz Etzbach

Signature of Inventor

Date March 16, 2000

Jean-Ganss-Str.46
67227 Frankenthal
Germany *DEX*
Citizen of: Germany
Post Office Address: same as residence

Rüdiger Sens
NAME OF INVENTOR

Rüdiger Sens

Signature of Inventor

Date March 16, 2000

Faselwiese 15
67069 Ludwigshafen
Germany *DEX*
Citizen of: Germany
Post Office Address: same as residence

Claudia Kräh
NAME OF INVENTOR

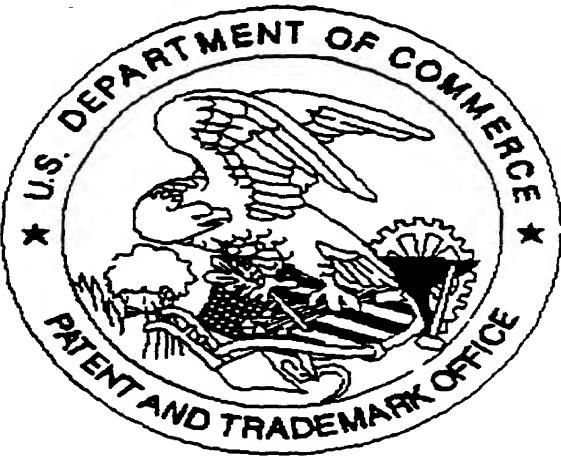
Claudia Kräh

Signature of Inventor

Date March 16, 2000

Ruchheimer Str.1
67112 Mutterstadt
Germany *DEX*
Citizen of: Germany
Post Office Address: same as residence

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